Name: ____________________ Date: ____________

Polynomial Operations SOLUTION (version 159)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -8x^5 - 10x^4 - 9x^3 + 7x + 1$$

$$q(x) = 10x^5 + 2x^4 - 3x^3 + 4x^2 - 7$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (-8)x^5 + (-10)x^4 + (-9)x^3 + (0)x^2 + (7)x^1 + (1)x^0 \\
q(x) &= (10)x^5 + (2)x^4 + (-3)x^3 + (4)x^2 + (0)x^1 + (-7)x^0 \\
p(x) - q(x) &= (-18)x^5 + (-12)x^4 + (-6)x^3 + (-4)x^2 + (7)x^1 + (8)x^0 \\
p(x) - q(x) &= -18x^5 - 12x^4 - 6x^3 - 4x^2 + 7x + 8
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 7x^2 - 6x - 3$$

$$b(x) = -7x + 2$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$7x^2$	$-6x$	-3
$-7x$	$-49x^3$	$42x^2$	$21x$
2	$14x^2$	$-12x$	-6

$$a(x) \cdot b(x) = -49x^3 + 42x^2 + 14x^2 + 21x - 12x - 6$$

Combine like terms.

$$a(x) \cdot b(x) = -49x^3 + 56x^2 + 9x - 6$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 159)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 17x^2 + 10x + 14 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 2 & 17 & 10 & 14 \\ -8 & & -16 & -8 & -16 \\ \hline & 2 & 1 & 2 & -2 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 2x^2 + x + 2 + \frac{-2}{x+8}$$

In other words, $h(x) = 2x^2 + x + 2$ and the remainder is $R = -2$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 17x^2 + 10x + 14$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (2)\cdot(-8)^3 \ + \ (17)\cdot(-8)^2 \ + \ (10)\cdot(-8) \ + \ (14) \\ &= (2)\cdot(-512) \ + \ (17)\cdot(64) \ + \ (10)\cdot(-8) \ + \ (14) \\ &= (-1024) \ + \ (1088) \ + \ (-80) \ + \ (14) \\ &= -2 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x+8$. Thus, $f(-8) = -2$.